

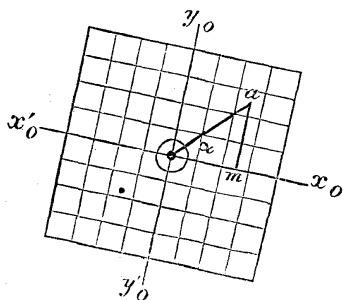
The Stereo-micrometer.

By Professor Chas. V. Zenger.

The stereo-micrometer is a binocular apparatus, to be fitted to any kind of astronomical refracting or reflecting telescope, and is used for measuring at once small angles in the field of view, as, for instance: The position-angles of solar protuberances; of solar spots; of close double stars; of difficult comets; of the satellites of *Jupiter*, *Saturn*, and *Uranus*; finally, of the spectral lines in solar and stellar spectra.

It is also intended, if used with a day eyepiece, to give the position of any terrestrial object, by placing the telescope at two different points, a and b , of a stand-line, measuring thus the coordinates x and y of the same point in two positions, and therefore its parallax, or the distance z by the horizontal parallax, to be deduced from the measurements made on the micrometer, viz., the differences of x and y .

It is constructed on the stereoscopic principle, and consists of two draw tubes exactly similar, with homofocal lenses, both mounted parallel to the axis of the telescope, with an arrangement for different distances of eyes. Looking through the double eyepieces, one being placed before the image of the star in the focus of the telescope, the other having been placed before an ocular micrometer divided in $\frac{1}{10}$ mm or $\frac{1}{20}$ mm, forming a grate of small squares on one side of a thin plate of mica; the image of the micrometer is thus projected on the images of the stars in the telescope, the fifth or inside line ($x_0 x'_0$) of it being set parallel to the diurnal motion; it is easily to be conceived that if a be a comet or a planet or star placed with its centre at o , $am=y$, $om=x$ will be respectively the differences of declination



and right ascension of both, and $\tan a = \frac{y}{x}$

will measure the angle between the centre of the star and its comae, taking the direction of the diurnal motion as zero.

The diameter of the planet, the distance of the satellite, the angle of position, or the differences in Declination and R.A. may be thus observed at a single glance, marking only the number of the small square where the satellite (a) will be seen, and its position in it.

In my Busch Refractor, 4" aperture and 1^m.5 focal distance, the image of the Sun holds nearly 15^{mm} in diameter: 15^{mm} therefore being equivalent to 300 divisions of the micrometer divided in $\frac{1}{20}$ mm, and magnified 25 times by a Ramsden eyepiece, one division being $\frac{1920''}{300} = 6''.4$, it is easy to discern by the eye $\frac{1}{10}$ to $\frac{1}{20}$ of a division in both directions, or nearly 0''.6 to 0''.3. There

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could easily be placed in the micrometric eyepiece a pair of movable wires to measure accurately in both directions the position of a in the small square.

The fifth and tenth squares are marked red and blue to read easily the number of the little squares, where a is visible, and on the back side of the mica-plate there is a rough numbered division for the same purpose, sufficiently visible, because the mica is very thin.

The eye, when first looking through the double eyepiece, cannot discern whether the micrometer be placed before the right or the left eye, at least if there is not too large a difference of focus between both eyes.

The greatest usefulness will be for measurements of faint celestial objects suffering from illumination of the wires in the field; for it is a physiological fact that the left eye, for instance, may look on the sharply illuminated micrometer without affecting the perfect visibility by the right one of faint comets or satellites, as those of *Saturn* for instance, allowing thus of less aperture for such difficult work, and finishing measurement in a moment, with a single glance at the object. Finally, we can by means of it measure the position of protuberances relative to the solar equator, their height and diameters; also, by simply fixing the number of squares where they are visible and the amount, the smallest displacement of spectral lines will be likewise measurable by it.

Its use is universal for every kind of astronomical and spectroscopical work; but it also could be used for geodetical surveys, giving three coordinates, viz., x , y , and by their differences the parallax of every point taken from a stand-line ($a b$) of known length, from which parallax may be deduced the horizontal parallax, and therefore the distance, or the third coordinate z , for every point measured with the stereo-micrometer.

I made also use of photography for the same purpose, taking with an orthoscopic lens two views on both ends of the stand-line, and using plates, on which were formerly made photographs of a similar square micrometer from a drawing on paper or cardboard. These photographs, well dried, were covered again with a sensitive film of collodion, and oriented exactly on the same point of the landscape for every image taken. Both projections of the landscape gave x , y and x' , y' for both ends (a and b) of the stand-line, and their differences the parallax of every point (or z), and the distance of the point from the optical centre of the orthoscopic lens.

The shrinkage of the collodion film, at least on albumenised plates, will have scarcely a perceptible influence on the exactness of measurement, inasmuch as it will be nearly uniform for both films, the first bearing the image of the micrometer and the second film with the photograph of the landscape being superposed on the former. It is essential to use always the same collodion, of the same thickness, and sensitised in the same bath.

Prague, 1876, January.